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## ASEAN 5+1 Bond Market Integration

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### ABSTRACT

This study is an attempt to analyze the linkages of the government bond yields of the ASEAN5 countries and China for the period August 11, 2009 to March 28, 2014. Applying vector autoregressive (VAR) model to daily observation showed that these sample bond markets are mainly associated with the past history of their own, but with considerable effects among the bond markets. The vector error correction (VEC) model and the impulse response function (IRF) model were also used to examine further the dynamic linkages among the markets, leading to a conclusion that government bond yields of the ASEAN 5 and China were affected mainly by their own shocks with some impact to and from a few ASEAN 5 countries' government bond yields. This paper provides empirical evidence that bond market integration among China and the ASEAN 5 countries is already apparent two years after the release of the 2012 Asian Development Bank Report known as the ASEAN +3 Bond Market Guide, which was done under the ASEAN+3 Bond Market Initiative (ABMI) to support the ASEAN+3 Bond Market Forum (ABMF).

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## INTRODUCTION

Over the past two decades, we have seen notable changes in the structure of the financial systems in Asia with market-based financial systems slowly competing with banks in providing financial services. The change precipitated the way funds are channeled into the system through the creation of financial innovations. The debt market showed promising prospects. Specifically, bond markets in Asia have developed remarkably, notably in emerging economies (Hyun and Jang, 2008). Shimizu (2010) observed that Asian bond issuances increased by 11.3 times, with government issues higher than corporate issues.

To date, bond market development has become an important policy issue among national authorities, standard-setting bodies and other international organizations. Hence, various financial structures, support systems and substructures were established to facilitate the development of this market. Regional initiatives such as Asian Bond Market Initiative (ABMI), ASEAN Capital Market Forum (ACMF), and ASEAN Bond Market Forum (ABMF) were created. ASEAN +3 member countries have been working to develop bond markets in the region under the ABMI since 2003. Thanks to the regional efforts, as well as individual country's commitments, the ASEAN +3 bond markets have grown rapidly, more than 3 times since 2003 (ADB Report, 2012). Bond markets have developed to the point where they have begun to serve as a spare tire in case other parts of the financial system are impaired; and where foreign investors are now eager to expand their investments in local currency fixed income assets (Felman, Gray, Gosuwami, Jobst, Pradhan, Peiris and Senevirante, 2011).

While the bond markets are growing rapidly, intra-regional financial flows are still comparatively small. On this front, ASEAN +3 Finance Ministers urged in their 13<sup>th</sup> joint ministerial statement in 2010 to explore ways to further promote cross-border bond transactions in the region. Besides fostering a credit culture to deepen local debt markets, the issue of critical size can be addressed through an integrated regional market for local currency bonds that provides greater scale, efficiency and access (Goswami and Sharna, 2011). Against this backdrop, the researcher would like to evaluate if the bond markets in the ASEAN +3 region has become more integrated.

The study however, considers only the five original founders and more developed ASEAN countries, namely: Indonesia, Malaysia, Philippines, Singapore and Thailand given that difference in levels of economic development would disharmonize markets in the region. The study will also concentrate on the assessment of

bond market integration of the ASEAN 5 countries with one of the +3 countries, China, which is the 2<sup>nd</sup> largest economy in the world and with bond market which is comparable to the largest in the world.

### ***Literature Review:***

It is believed that financial markets can function effectively and efficiently in the provision of financial services. Shimada and Yang (2010) examined the financial systems in Southeast Asia and found that after the Asian crisis, SEA economies reflected stability of the institutions and markets during the global crisis which can be ascribed from the effective provision of micro- and macro-prudential regulations. Since the Asian financial crisis, countries in Asia have made continuous strenuous efforts to promote financial cooperation with a focus on developing the bond market in the region (Hyun and Jang, 2011). Bond market development is essential to avoid the “double mismatches” of maturity and currency that exacerbated financial crisis in East Asia and to recycle huge Asian savings without having to channel through financial markets of advanced countries. The study of Bhattacharyay (2011) attempted to identify the major determinants of bond market development in Asian countries through examining its relationship with key financial and economic factors, and to provide policy recommendations for further developing Asian bond markets. Earlier, Vo and Daly (2007) investigated the potential “drivers” of international financial integration including policy on capital controls, the level of economic and educational development, economic growth, institutional and legal environment, trade openness, financial development and tax policies.

Much of the research by academics on the issue of financial integration has concentrated on the issues relating to equity market integration (Lucey and Steely, 2006). However, the literature investigating relationships and integration in bond markets is very thin (Vo, 2009). There are only a few studies on the relationships among different bond markets, and especially so when it comes to Asia (Johansson, 2008).

The studies of Yang (2005), Ciner (2007) and Jeon, et. al. (2012) examined linkages among government bond markets of developed countries, including Japan, with diverse findings. Yang found no long-run relationship exists among the subject bond markets during the sample period. Similarly, Ciner's work showed that the bond markets are not co-integrated in the full sample, but there was evidence for a stable relationship in the latter part of the sample. Finally, Jeon, et.al found the Japanese bond market to be independent of other major national bond markets, but it exerts some influence in determining bond yields in bond markets of the major industrial countries.

Two studies that focused on analyzing interdependencies among Asian bond markets are by Johansson (2008) and by Vo (2009). The paper of Johansson contained co-integration tests showing that the Asian bond markets exhibited strong long-term interdependencies. Meanwhile, the research of Vo showed that there was a low degree of integration in Asian bond markets which imply that the markets operate largely independently of one another.

An earlier study by ADB (2005) focused on bond market settlement and emerging linkages in selected ASEAN +3 countries and found that bond markets in the region are at very different stages of development; and although no formal data are available on the volume or value of cross-border trading in bonds, anecdotal data indicate that it is very small. Seven years after, the ADB (2012) reported that bond markets in ASEAN +3 countries have developed and grown rapidly but are still less integrated.

The relatively few studies on Asian bond market integration and the scant research on ASEAN +3 bond market linkages, both with varied results, merit the conduct of the present study.

### ***Methods:***

#### ***Data Measure:***

The data consist of daily government bond yields from the subject Asian bond markets over the period 08/11/2009 to 03/28/2014 (the period when bond markets in the ASEAN +3 countries have grown rapidly) consisting of 878 observations. Should daily yield in one country be missing for a particular date, the yields for all the subject markets for that date are not included in the tests. Data are collected from [www.investing.com](http://www.investing.com).

Government bond yields are for those with five years to maturity and are in domestic currency. The choice for the domestic currency is in line with a salient feature of the ADB Report (2012) that Emerging East Asia local currency (LCY) bonds have become an important asset class, which cannot be overlooked by investors. This is also to avoid the compounding effect of the region-wide currency devaluation after the occurrence of a crisis (Yang, et. al., 2005) like the global financial crisis from 2008 to 2010. Besides, Jeon, Jiand Zhang (2012) considered bond market data measured both in local currency and in exchange-rate adjusted form and found no great changes in their empirical findings.

#### ***Data Analysis:***

The present study used the following descriptive and econometric tools: mean, standard deviation, correlation analysis, unit root tests, Johansen multivariate co-integration test, vector autoregressive (VAR) model, Granger causality test, vector error correction (VEC) model and impulse response function (IRF) model.

The econometric measures were all tested using 5% significance level unless it is also feasible to test at 1% level of significance. The e-views software is employed in running all the tests.

### Results:

Table 1 shows the descriptive statistics for the government bond yields from the subject bond markets. The bond yields of Indonesia and the Philippines are the most volatile while the yields from the other countries are quite stable.

**Table 1:** Summary Statistics of Government Bond Yields (Percentage).

Countries	Average	Standard Deviation
China	3.31	0.48
Indonesia	6.75	1.39
Malaysia	3.43	0.20
Philippines	4.90	1.17
Singapore	0.83	0.34
Thailand	3.33	0.39

### Simple Correlation Test:

The results of the simple correlation analysis are shown Table 2. All the countries have significant linear association in their government bond yields, except for China with Singapore. The negative correlation of the Philippines with China means that an increase in the government bond yields in the Philippines leads to a decrease in the yields of China. The strong positive linear association of Indonesia bond market with Malaysia and Singapore leads to an increase in portfolio risk for international portfolio managers while the negative correlation of the Philippines with China market provides diversification potential. However, this observation is for the short-term only because correlation reflects short-term co-movements in yields while co-integration measures long-run co-movements (Dunis and Ho, 2005).

**Table 2:** Simple Correlation of Government Bond Yields.

	China	Indonesia	Malaysia	Philippines	Singapore	Thailand
China	1.000					
Indonesia	0.067*	1.000				
Malaysia	0.111*	0.901*	1.000			
Philippines	-0.536*	0.477*	0.435*	1.000		
Singapore	0.031	0.803*	0.795*	0.428*	1.000	
Thailand	0.368*	0.195*	0.332*	-0.083*	0.154*	1.000

\* Significant at 5% level

### Unit Root Test:

The null hypothesis of non-stationary (there is one unit root) is tested for the individual unit root process, using Dickey-Fuller test. The test employed automatic selection of maximum lags based on Akaike Information Criterion (IAC) to ensure that the error term is white noise and free of serial correlation. The IAC yielded lags from 0 to 13. The assumption of one unit root or random walk at 5% significant level is supported for all the countries except for Singapore. While it is true that unit root test allows us to determine if markets are individually efficient, it does not measure long-term collective market efficiency (Mandigma, 2013). Co-integration analysis is a better gauge to use.

### Multivariate Co-integration Test:

The data series for all the countries were tested for the existence of long-run co-integration relationship through Johansen trace test and maximum Eigenvalue test. Both trace and max-eigenvalue tests indicate co-integration at the 0.05 significance level as shown in Table 3.

**Table 3:** Multivariate Co-integration Test.

Hypothesized No. of CE(s)	Pre-Crisis Period	
	Trace Test Statistic	Max-Eigenvalue Statistic
None	155.01*	75.16*
At most 1	79.85*	30.01
At most 2	49.84*	24.19
At most 3	25.64	13.18
At most 4	12.46	6.88
At most 5	5.58*	5.58*

\* indicates rejection of the null hypothesis at the 5 percent level of significance

### Vector Autoregressive Model:

Despite the presence of co-integration, the VAR model was still used to investigate further the relationship among the different government bond yields. An unrestricted VAR model was used with 6 lags based on the AIC optional number of lags. Results of the VAR estimation are shown in Table 4.

**Table 4:** VAR Model Estimation Results.

	China	Indonesia	Malaysia	Philippines	Singapore	Thailand
China_1	0.28**	-0.02	0.00	0.03	0.01	0.03
China_2	0.20**	-0.02	0.00	-0.01	0.00	0.00
China_3	0.17**	0.05	0.00	0.01	-1.42E-05	0.02
China_4	0.12**	-0.00	0.00	-0.03	-0.00	-0.03
China_5	0.11**	0.02	-0.01	-0.02	-0.01	0.06
China_6	0.07*	-0.02	0.00	0.03	0.01	-0.01
Indon_1	-0.05	0.73**	0.03**	0.05*	0.02*	0.18*
Indon_2	0.05	0.16**	-0.01	-0.02	-0.01	0.00
Indon_3	0.03	0.03	0.00	-9.69E-05	4.40E-05	-0.11
Indon_4	-0.01	0.07*	-0.01	-0.014	-0.01	0.03
Indon_5	-0.02	-0.02	-0.01	-0.03	-0.00	-0.11
Indon_6	0.01	0.01	-0.00	0.00	0.00	-0.06
Malay_1	0.13	0.29*	0.90**	0.38**	0.05	0.43
Malay_2	-0.08	-0.19	-0.03	-0.33*	-0.11*	-0.03
Malay_3	0.05	0.22	0.04	-0.07	0.05	0.22
Malay_4	-0.00	-0.19	0.07	0.2	0.06	0.45
Malay_5	0.00	-0.21	-0.06	-0.03	-0.03	-0.42
Malay_6	-0.14	0.06	0.01	-0.12	0.03	-0.03
Phil_1	-0.07	0.04	-0.00	0.80**	-0.02	0.09
Phil_2	0.01	-0.07	-0.00	0.17	0.02	-0.21
Phil_3	-0.02	0.05	-0.00	-0.06	-0.02	0.07
Phil_4	0.04	-0.03	-0.02	0.06	0.02	0.03
Phil_5	0.03	0.07	0.00	0.01	-0.02	-0.12
Phil_6	-0.01	-0.08	0.02*	0.03	0.01	0.14
Sing_1	0.07	0.10	0.04*	0.25**	0.99**	-0.04
Sing_2	0.02	-0.12	0.00	-0.23*	-0.06	-0.14
Sing_3	-0.09	-0.17	-0.00	0.17	0.07	-0.20
Sing_4	-0.01	0.09	-0.02	-0.14	-0.03	-0.60*
Sing_5	0.02	0.12	-0.04	0.14	0.00	1.18**
Sing_6	-0.01	0.09	0.02	-0.16*	0.02	-0.19
Thailand_1	0.01	0.03*	0.00	0.01	-0.01	0.15**
Thailand_2	-0.01	-0.07**	-0.00	-0.01	-0.00	0.12**
Thailand_3	0.00	0.05**	0.00	0.01	0.00	0.12**
Thailand_4	0.01	0.01	0.00	0.00	-0.00	0.12**
Thailand_5	-0.00	0.01	-0.00	0.00	-0.00	0.10**
Thailand_6	-0.00	-0.03*	-0.00	-0.01	-0.00	0.10**
Constant	0.25	0.20	0.17**	-0.15	-0.05	-0.91**

\* Significant at 5% level

\*\* Significant at 1% level

China is mainly associated with the past history of its own and is relatively independent. All the ASEAN 5 bond markets are associated with their own respective past history and with a few other subject markets, meaning, the different ASEAN 5 bond markets exert some influences among themselves.

### Granger Causality Test:

Co-integration between two variables implies existence of long-run causality for at least one direction thus; testing co-integration and causality should be considered jointly (Lin, 2008). Granger causality test was used to check if there are causal relationships among the government bond markets. Just like in the unrestricted VAR model, lag 6 based on AIC optimal number of lags was also used in the Granger causality test. The null hypothesis is that the independent variable does not granger cause the dependent variable. Table 5 shows the results of the Granger causality test.

**Table 5:** Granger Causality Test.

Dependent Variable	China	Indonesia	Malaysia	Philippines	Singapore	Thailand
China		0.69	0.47	1.52	0.25	0.20
Indonesia	0.87		2.76	2.08	2.93*	4.91*
Malaysia	0.61	6.67*		1.25	3.20*	0.14
Philippines	1.53	3.06*	5.63*		5.03*	0.74
Singapore	0.73	0.98	0.70	1.62		0.40
Thailand	1.09	2.90*	1.77	0.83	2.37*	

\* indicates rejection of the null hypothesis at the 5 percent level of significance

Indonesia Granger cause Thailand which also Granger cause it in return while a unidirectional causality is detected from Indonesia to Malaysia and Philippines. A unidirectional causality is also detected from Singapore running to Indonesia, Malaysia, Philippines and Thailand. These causal interactions are visibly explained in the diagram in Figure 1.

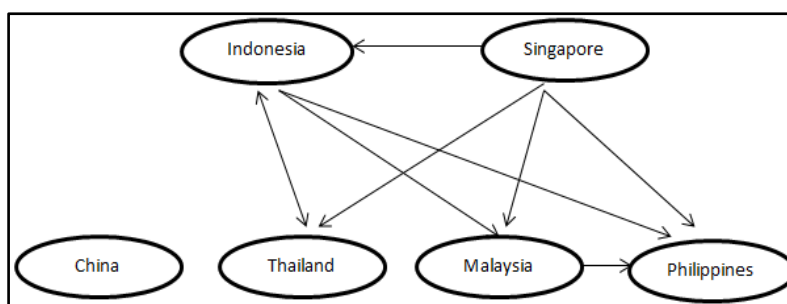


Fig. 1:

**Vector Error Correction (VEC) Analysis:**

Granger causality test only shows the current relationship among the government bond yields without measuring magnitude, speed or dynamics of the influence. These last measures can be detected by variance decomposition. To get the relative magnitude of the influence among China and the ASEAN countries, a vector error correction (VEC) model was conducted. Table 6 shows the result of the 12-month forecast variance decomposition.

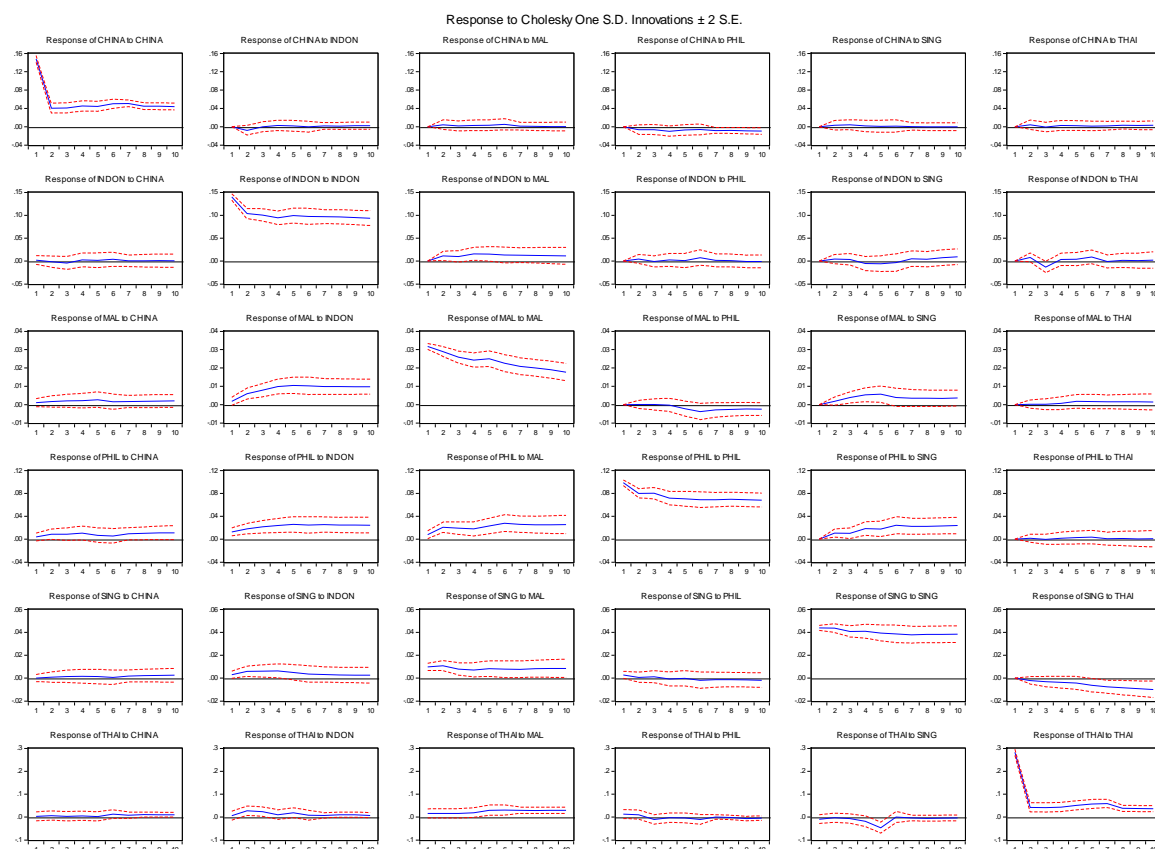
**Table 6:** Forecast Error Variance Decomposition Results (Percentage).

Month	China	Indonesia	Malaysia	Philippines	Singapore	Thailand
<b>China</b>						
1	100.0	0.0	0.0	0.0	0.0	0.0
2	82.6	2.2	3.3	5.4	0.0	6.5
3	88.3	1.7	2.5	.8	0.0	6.7
12	75.3	3.4	9.0	1.0	0.0	12.4
<b>Indonesia</b>						
1	2.1	97.9	0.0	0.0	0.0	0.0
2	0.0	75.7	13.2	7.4	3.7	0.0
3	2.8	77.5	13.4	6.3	0.0	0.0
12	4.3	61.5	22.4	11.8	0.0	0.0
<b>Malaysia</b>						
1	3.0	3.0	94.0	0.0	0.0	0.0
2	2.5	10.0	72.5	10.0	2.5	2.5
3	0.0	10.3	71.8	10.3	0.0	7.7
12	2.9	26.5	52.9	11.8	0.0	5.9
<b>Philippines</b>						
1	0.0	11.4	7.3	81.3	0.0	0.0
2	0.0	13.9	10.2	75.9	0.0	0.0
3	0.0	13.1	8.4	78.5	0.0	0.0
12	0.0	17.9	1.1	81.0	0.0	0.0
<b>Singapore</b>						
1	0.0	3.5	14.0	7.0	75.4	0.0
2	0.0	4.7	15.6	12.5	64.1	3.1
3	0.0	6.2	15.6	12.5	60.9	4.7
12	0.0	16.1	14.3	14.3	50.0	5.4
<b>Thailand</b>						
1	2.4	0.3	5.6	2.4	3.3	86.1
2	10.5	19.3	14.4	5.0	2.8	48.1
3	10.2	0.0	21.6	5.4	1.2	61.7
12	34.9	0.0	42.9	4.8	0.0	17.5

The forecast error variance of each ASEAN 5 and China bond markets are mostly explained by each own respective country and the explanatory power become smaller over time. Singapore has the least power to explain the forecast error variance of all the other markets. Of the markets studied, it is only the Philippines where forecast error variance is explained the least by other markets with only Malaysia and Indonesia showing some influence aside from itself. With the exception of the foregoing, all the ASEAN 5+1 countries' forecast error variances were considerably explained by all the other markets.

**Impulse Response Function (IRF) Analysis:**

To get more insights into the dynamic linkages among the government bond yields of the ASEAN countries and China, impulse response function (IRF) analysis was conducted, results of which are shown in figure 2.



**Fig. 2:**

All the subject countries' government bond yields are affected mainly by their own respective shocks in a decreasing pattern with some impact to and from a few other countries. The other markets that have considerable positive response to shocks from Indonesia are Malaysia and the Philippines; from Malaysia are Philippines and Singapore; from Singapore are Malaysia and Philippines; negatively from Philippines to Indonesia and from Thailand to Singapore.

### **Conclusion:**

Harmonization and integration will benefit a larger scale of the economy and will increase efficiencies because integrated markets may be able to mitigate the mismatch of funds: vast savings on the one hand, and enormous needs for investments on the other (ADB Report, 2012) by effecting cross-border bond transactions along with the development of local currency-denominated bond markets. Hopefully, cross-border, cross-currency links do not create risks with which the financial sector safety nets cannot cope (Gray, Felman, Carvajal and Jobst, 2011).

The present study examined the linkage between the locally-denominated government bond yields of China and those of the more mature ASEAN 5 countries: Indonesia, Malaysia, Philippines, Singapore and Thailand.

All the tests employed in the study showed considerable influence among the bond markets of China and the ASEAN 5 countries except for a few trivial effects or responses. The short-term significant linear association among the subject countries was determined using simple correlation test while long-run co-movements was uncovered using Johansen multivariate co-integration tests. Even the VAR model showed that all the bond markets are mainly associated with the past history of their own and are not relatively independent because there was a few significant effects to and from the other bond markets. The Granger causality test resulted to some causal relationships among the government bond yields which were boosted by the 12-month forecast error variance decomposition (VEC) and the impulse response function (IRF) analyses. These last two analyses emphasized that the government bond yields of the subject markets were affected mainly by their own shocks with some significant impacts to and from the other bond markets.

In conclusion, this paper provides consistent empirical evidence that linkages of the bond markets of the ASEAN 5+1 countries are now apparent two (2) years after the release of the Asian Development Bank Report in 2012. However, more work lies ahead because it will take a long time and costs for Asian countries to develop and put into practice a single or harmonized regulatory framework necessary to establish efficient cross-border/regional bond markets that will function like the integrated Euro bond market (Hyun and Jang, 2008).

The present study has some limitations. Firstly, the results of the current research may change if the frequency of observation is adjusted from daily to weekly or monthly data. Secondly, the sample period chosen may be too short and must be expanded to include more data starting from 2009 when sizable increase in government LYC bonds started to be recorded up to 2015 when ASEAN integration is expected to be fully implemented.

Both the results and the limitations of the study point to further research with the suggested changes mentioned in the preceding discussion plus the following: sample countries preferably must include all the ASEAN member countries and the +3 nations, and a fine-grained analysis of decision-making on the investment process as suggested by Hussain and Shafique (2013) may back-up the results of the econometric tests.

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